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Viable Scheme for Regional Fuel Cycle Center
- Issues and Strategies -

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1. Introduction

In October 1973, the energy crisis began in most dramatic fashion. Americans experienced a discomfort that they had not known before. Throughout the 1970's, there seemed to be one energy crisis after another, not only in the United States but all over the world. During First Oil Shock, the most oil importing countries were busy searching for the alternative energy to oil. Many countries chose nuclear energy as an alternative and expanded their nuclear power program to meet growing electric power demand.

In order to counter such situations, IAEA Director General Dr. Sigvard Eklund started Regional Nuclear Fuel Cycle Center (RFCC) study project in 1974 to assess if RFCC would have significant advantages for back-end of nuclear fuel cycle activities, in addition to making substantial contributions towards the goals of non-proliferation.

2. RFCC study project

This project was the most comprehensive and extensive feasibility study for the regional cooperative project to cover entire back-end fuel cycle. While the full study effort in the IAEA was getting under way, the first NPT Review Conference in May 1975 took account of this effort and emphasized certain aspects such as scale merit and easiness of safe guard ability.

The Final Declaration of Conference states, in this connection, that:
"The Conference recognizes that regional or multinational nuclear fuel cycle centers may be an advantageous way to satisfy, safely and economically, the needs of many States in the course of initiating or expanding nuclear power programs, while at the same time facilitating physical protection and the application of IAEA safeguards, and contributing to the goals of the Treaty. The Conference welcomes IAEA's studies in this area, and recommends that they be continued as expeditiously as possible. It considers that such studies should include, among other aspects, identification of the complex practical and organizational difficulties, which will need to be dealt with in connection with such projects.

The Conference urges all parties to the Treaty in a position to do so as to cooperate in these studies, particularly by providing IAEA where possible economic data concerning construction and operation of facilities such as the chemical reprocessing plants, plutonium fuel fabrication plants, waste management installations, and longer term spent fuel storage, and by assistance to IAEA to enable it to undertake the feasibility study concerning the establishment of regional nuclear fuel cycle centers in specific geographical regions.

The Conference hopes that, if the studies lead to positive findings, and if the establishment of regional or multinational nuclear fuel cycle centers is undertaken, Parties to the Treaty in a position to do so, will cooperate in, and provide assistance for, the elaboration and realization of such projects."

Shortly afterwards, at the Nineteenth Regular Session of the IAEA General Conference in September 1975, a number of Member States responded with the statements of full support for the study, including the offer of any additional resources needed to make the Study Project as useful as possible. The report of RFCC Study Project was published in 1977 with positive findings. However, as Study Project turn to second phase, US objected for actual establishment of Asian RFCC in view of potential risk on sensitive reprocessing technology proliferation through such center. RFCC study report provided a solid basis for international or regional approaches for the back-end of fuel cycle center in any geographical location as long as clear needs and demand exist.

3. International Nuclear Fuel Cycle Evaluation(INFCE)

Initiated by Carter Administration to assess global optimal fuel cycle strategies on 19 October 1977 in Washington, DC for three and half years to complete the evaluation with IAEA secretariat's administrative support.

The Conference Communiqué states that the Participants:
"were conscious of the urgent need to meet the world's energy requirements and that nuclear energy for peaceful purpose should be made widely available to that end; were convinced that effective measures can and should be taken at the national level and through international agreements to minimize the danger of proliferation of nuclear weapons without jeopardizing energy supplies or the development of nuclear energy for peaceful purposes;
recognized that special consideration should be given to specific needs of and conditions in developing countries."

Eight working groups were established and chaired by countries that volunteered to assume the responsibility. Each working group operated independently and is solely responsible for its own report and findings. Many working groups considered the Fuel Cycle Center as one of the institutional arrangements proposed to strengthen proliferation resistance of fuel cycle. It took as a starting point the IAEA-RFCC study on LWR regional fuel cycle centers. It concluded that, from the view point of nonproliferation, a multinational or international facility could form an attractive institution, for example by

providing easier safeguards implementation, economy of the scale merits and by making unauthorized operation more difficult. A preliminary comparison between the multinational and international solutions seems to show that multinational schemes offer slightly fewer difficulties with regard to ownership and have relatively fewer problems. However, in view of the complexity of the problems, careful evaluation would be required before any implementation. Studies of co-location should refer to specific sites of which a proper evaluation of the environmental impact and the implications for local communities can be made and public acceptance verified.

Countries with larger nuclear program will most probably use their own national facilities or institutions for spent fuel management. However, there are countries that do not have, and do not plan to have, within their national borders all the step of the back-end of the fuel cycle. Thus, they depend on foreign nuclear industries and services. Therefore, adequate interim storage capability must be provided in support of spent fuel concepts of these countries. There are also countries that have not taken any decision at present to develop all the steps of the back-end of fuel cycle but have decided to build national AFR facilities.

The evaluation-identified situations where ways of resolving spent fuel management problems need to be considered. The required solutions involve both the legal framework and institutional practices and they should also take into account the fact that the magnitude of the problem varies widely from country to country. In connection with all international or multinational arrangements, it is recognized that decisions would be required on such sensitive questions as membership, financing, voting arrangements, condition of access, dispute settlement, status of the host government and the likes. It was noted that a solution would have to be found for avoiding possible interference by the host government.

4. Internationally Monitored Retrievable Storage System(IMRSS)

IMRSS was proposed during the Global ‘93 Conference by Prof. W. Haefele of Germany and supported by Dr. C. Starr of United States. For the transition period of few decades up to a second wave of the nuclear technology, it is proposed to take two specific actions. To build and operate two or three IMRSS, preferably under auspices of IAEA, and TO INSTALL A SISTER ORGANIZATION to successful International Commission on Radiation Protection (ICRP), namely the International Commission on Nuclear Disposal (ICND). ICND would function as an independent body with purpose of giving recommendations for standards, criteria and regulations except the radiological aspects of nuclear waste disposal.

IMRSS would be able to relieve the urgent pressure from growing accumulation of spent fuel storage at operating nuclear power plant and buy time until final decision on what to do with valuable spent fuel – either reprocess and plutonium thermal recycle as MOX or dispose to the final repository as waste.

There are also similar idea proposed by Prof. Atsuyuki SUZUKI, University of Tokyo. It propose Regional Storage of Spent Fuel in East Asian Region. There are differences between these two proposals. However, the scope of both concepts is mainly limited to the interim storage of spent fuel for finite period. Thus, the difficulties likely to encounter in due course of implementation for establishing storage facilities in East Asia region would be much simpler than IAEA/RFCC. I would think that the required processes and approach would be same regardless of the variation in the scope of fuel cycle activities.

5. International Interim Storage Scheme(IISS) of High Level Radioactive Waste and Spent Fuel(HLW/SF)

The developing countries with three fourths of the world population at present consume only one third of the global commercial energy. These countries expand their energy consumption for agriculture, households, transportation, and industry to improve productivity and quality of life to the level of developed countries. This has been particularly evident in the very fast developing Asian Economies. In new Millennium, both developed and developing countries are more concerned about managing economic growth without depriving future generations of sound base of natural resources and a healthy environment. Key to meeting this challenge is to optimize energy use and supply options in harmony with the environment.

If present plans come to fruition, the countries of Asia will account for over 75% of the increase in global nuclear power capacity to 2010. These assumptions are likely to hold despite the economic crisis encountered from 1997. The fundamentals for long-term growth and prospects for the region are strong, and likely to be translated into a sustained rapid increase in demand for electricity. In contrast, Nuclear capacity in North America and Western Europe appears to have stalled, and it is uncertain whether additional nuclear capacity will be brought into operation in these regions over the next twenty years. Asia is therefore likely to become the new center of future nuclear power development. This development raises a variety of issues of importance both to Asian region, and to the rest of the world.

The International Energy Agency (IEA) assumes that roughly 75-80% of the energy needs of Asia will be met by an approximate doubling of coal and oil use. Gas use will also double, but will nevertheless meet only about ten percent of overall energy needs. Use of electricity is projected to grow by a factor of two to three, with nuclear energy making a significant contribution to meeting the needs for power in a number of Asian countries. Providing this needed power without worsening region's already serious environmental degradation represents a major challenges.

The higher energy demand will result not only from very fast economic development, but also from faster population growth. The evolution of energy use has been toward sources of higher energy density, notably to source, which yield more energy than others per weight of fuel do. They are less bulky and easier to transport and store and better economy. In order to achieve sustainable development in this Century, the wise choice of

optimum energy mix should be selected to harmonize energy uses with the minimization of future environmental impacts.

Recognizing that HLW/SF management is a common and important problem among East Asian nuclear power programs, and that it could inhibit further development of nuclear power if not satisfactorily addressed, the Pacific Nuclear Council (PNC) launched study project in April 1997. The objective is to promote the understanding and collaboration of HLW/SF management among PNC member countries, and to investigate the feasibility of IISS for the management of HLW/SF on the informal basis.

The IISS will handle the SF generated from commercial reactors and the HLW from reprocessing for the peaceful use. It operate at national or regional as well as international level and has to be treated in a similar fashion as to the application of safety principles and standards – similar criteria, evaluations and procedures apply.
Thus, it is not a substitute, but rather complementing a national system. Once established, it is applicable during the contractual period which begin when a member deposit her HLW OR SF to custodian facilities and end when a member withdraw the HLW OR SF.

During the contractual period, the custodian country would be responsible for safe and secure storage and participating member would respect the sovereignty of custodian country providing IISS service, but retain the legal ownership of its HLW and SF. IISS service provider would receive adequate financial compensation from the contractual parties.

6. Other proposals

During the Global ’97, Dr. N. Egorov and others from the MINATOM, Russia proposed the possibility of storing spent fuel and HLW from the countries other than former USSR. For the reprocessing service of spent fuel shipped from the countries other than former USSR, the service can be provided only after the amendment of Russian relevant laws.

Various RFCC schemes were proposed during 80s and early 90s such as Gobi desert, Marshall Island and others. However, none of such scheme have been seriously and systematically studied nor discussed among the interested parties due to one reason or other.

7. Issues

The management of Spent Fuel (SF) and High Level Radioactive Waste (HLW) has become one of the most intractable problems associated with nuclear power generation. SF must be stored safely and securely at reactor sites, or at interim storage facilities away from reactors. If SF is to be directly disposed, suitable geological repository must be properly located to ensure the prolonged isolation of SF from human ecosphere. If SF is

be reprocessed, HLW must be solidified and safely stored, and eventually disposed in the geological repository.

The safe and secure storage of SF and eventual disposal of HLW has become a major public, political, environmental, and security concern for the country generating them, and for its regional neighbors. There are an increasing number of utilities in East Asia whose SF inventory is expected to exceed SF storage capacity before a geological repository is available. These utilities would have to expand the interim storage capacity for SF, or face premature shut down of their reactors.

A smaller country is unable to site storage and disposal facilities within its national border due to limited land area and/or dense population. Such country could eventually result in large accumulation of SF & HLW. For as long as SF & HLW management and disposal unresolved, the validity of nuclear power as an economic and clean energy option remains questionable. This could not only impact the existing nuclear power economies in East Asia, but the emerging nuclear market in ASEAN. AS a result, ASEAN would not commit to nuclear power investment.

8. Strategies

Given these situations, SF & HLW should be stored for time being at Regional Interim SF Storage until SF policy decision at appropriate time. The potential benefits would be as follows;

(1) Higher Efficiency

Regional scheme could resolve problems more efficiently than each country addressing issues individually. For example, higher efficiency could be achieved for the promotion of R & D for storage and disposal methods as well as the examination under various conditions due to joint effort.

(2) More siting flexibility

More flexibility can be expected for selecting facility sites since larger area of member states could be examined for such sites.

(3) Economic merits

Cooperation among member states lead to more efficient financing and larger scale of funding available. Economy of scale merit can be expected also.

(4) Easier transport fissile materials

During the transport of fissile materials, diplomatic issues raised sometimes when transport vessels pass international water or territorial water of other countries. International or regional scheme would promote mutual understanding. Thus, the much fewer such diplomatic frictions would be anticipated.

(5) Ensuring Transparency

When the fissile materials are under an international or regional scheme, these materials would be under IAEA safeguards, enhancing transparency.

(6) Confidence Building Measures

Dialogues and mutual cooperation among member states certainly contribute toward the Confidence Building among member states, leading stabilization of the region.

In spite of the enumerated potential benefits, none of RFCC proposals nor Regional Interim Spent Fuel Storage scheme even have been studied and discussed seriously as yet. Is it too early to discuss Regional Interim Spent Fuel Storage scheme in East Asia or are there definite proliferation risk from such scheme? Time is running out.

Due to some potential risks, can we afford not to rely on the benefits from peaceful uses of Nuclear Energy? Or are there any alternative to Nuclear Energy? With the growing international consensus on the harmful health and environmental impact on energy use, there is on the political level recognition of nuclear power's potential role in delivering large quantities of energy without releasing common environmental pollutants and greenhouse gases. With its remarkably low fuel requirements, nuclear power and cogeneration of heat supply for district heating or industries can contribute to meeting national and global sustainable development goals.

However, the current research progress on the innovative treatment and viable final disposal of SF and/or HLW in the specific potential site for deep stable geologic repository can not cope with rapid growth of SF accumulation at most nuclear power plants in East Asian region. In order to buy time until the viable technology and clear policy decision for the back end of fuel cycle, the Regional Interim Storage of Spent Fuel is essential for East Asia. This is the vital step to further expand the role of nuclear energy as advanced and innovative environmentally sound energy technology for the sustainable development in 21st Century.

The basis of viable scheme is the Mutual Confidence Building of the multinational member participation due to regional joint project execution possibly under IAEA auspices step by step approach. At the outset, the scope would be limited to the essential minimum such as Interim SF Storage only. If the first scope is successful, the next scope could be expanded to the geological repository and further step by step. This approach would be surely winning public support and confidence for the safe and secure storage of SF. Further assuring the transparency of public safety, final disposal of HLW could be made in the Regional Geological Repository.

Key to the success is the Mutual Confidence among the participating member states through multinational regional joint implementation, and neighboring countries. With its remarkably low fuel requirements, Nuclear Energy in the East Asia can contribute to meeting the national and global sustainable development goals.

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